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Davis, CA

FSCBG Version 4.35 One-On-One Training Notes

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FSCBG Version 4.35
One-On-One Training Notes

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Preface

This report is a summary of detailed notes taken during a 2-day one-on-one training session conducted on the Forest Service-Cramer-Barry-Grim (FSCBG) aerial spray model. The purpose of the training was to review all features of the model focusing on recent updates and to discuss needs and methods from a user viewpoint. The training was conducted by Milt Teske, Tom Curbishley, and Alina MacNichol, Continuum Dynamics, Inc. and was provided to Pat Skyler, USDA Forest Service. This report, when used in conjunction with the FSCBG user manual, should serve as a useful reference guide to other users of the model in providing answers to many of the questions which arise when setting up and interpreting FSCBG model runs. Additionally it provides many helpful hints in running the model and easy to understand definitions of several spray model terms.

FSCBG Version 4.35 One-On-One Training Notes
Continuum Dynamics, Inc. Technical Memorandum No. 95-12
July 1995

by

Milton E. Teske, Thomas B. Curbishley and Alina Z. MacNichol

These notes summarize the topics examined during the one-on-one FSCBG training session for Patricia J. Skyler, USDA Forest Service, held in the offices of Continuum Dynamics, Inc. on June 6 and 7, 1995. They were prepared in part to assist Pat and others in running both the "lite" and Advanced versions of FSCBG 4.35, and to answer questions that often arise when making model runs. These notes should be used in conjunction with the latest version of the FSCBG user manual.

Background

In all previous applications of the model (with the exception of the Utah 1991 drift study), only deposition and its drift deposition component have been requested (meaning that dosage and concentration have not been examined). Approximately 90 percent of Pat's model work comes from requests by Jack Barry in support of external customers. For these she uses an extended Information Sheet (printed at the back of the user manual) detailing all inputs to the Advanced version of FSCBG.

We spent the first full day reviewing every input and output menu in the model, with special emphasis on the "lite" version (Pat has only run Advanced). The morning of the second day was filled with a discussion of the specific questions summarized below; the afternoon of the second day was devoted to a detailed discussion of the Demo system in FSCBG. Along the way we also covered CASPR (the aircraft efficiency model) and the Spread Factor Data Base. Pat was also introduced to the Spray Drift Task Force aerial application model AgDRIFT (under development by Continuum Dynamics, Inc.).

Review Details

One specific aim was to begin using a simplified Information List (last page of this report) and running the "lite" version of the model the first time a new problem is attempted. In this way a minimum of inputs will be necessary (with the receptor grid generated automatically), and a first result will be generated that will help bring the entire problem into focus. The topics discussed included the following (in alphabetical order):

Aircraft Library: we examined how to add entries to the library. The trailing edge of the wing is the back edge where the nozzles go; the leading edge is where the wind first hits the wing.

Buffer Zone plot option: the zero distance position is located at the center of the farthest downwind flight line; this option recovers the composite deposition for ALL flight lines (within the target area) in the simulation (used most effectively by turning off Dosage, Concentration and Deposition in Model Selection -- this is the way the Canadians use FSCBG).

[illegible] Version [illegible] Training Notes
[illegible] Technical Memorandum No. 93-[illegible]
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by

[illegible] Thomas B. [illegible] and [illegible]

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Background

In all previous applications of the [illegible]

We spent the first full day [illegible]

[illegible] Details

[illegible]

[illegible]

[illegible]

Calculation Options: including the handoff and standard deviation. To recover drift, the Near Wake model should always be run with Ground as the handoff. Until a complete review of the dispersion module later this year, to recover isopleths, the Near Wake model should always be run with the Vortex Decay handoff. But: remember that deposition from the Near Wake model will not be accurate with the Vortex Decay handoff -- only with the Ground handoff. Wake Settling does not include the near wake. If both deposition on the target area and drift downwind are desired, it will be necessary to make two FSCBG runs for each scenario.

COMBINE: this stand-alone program enables the user to generate multiple flight line results from the solution of a single flight line prediction by FSCBG. This step is accomplished by placing a single line of Discrete Receptors beyond the flight line (and perpendicular to it). Two things must be remembered when setting up the model run: (1) the flight line's first or last X or Y location must be 0.0; and (2) the final combined pattern will shorten the distance covered by the line of discrete receptors by the number of flight lines simulated times the swath width. The user must make sure that discrete receptors are placed far enough beyond the flight line (spray block edge) to account for this restriction. The receptors may be spaced nonuniformly. The Combine feature will be built into a later version of FSCBG.

DEMO: all features and options in the demo, specifically the keyscript files and commands, were reviewed.

Discrete Receptors: outward normals (defining the receptor direction) must be developed very carefully. Generally, with cards on the ground, there is no problem; the outward normal is (0,0,1) pointing upward. For cans or cards hung vertically, the SIDE desired must be selected by the user (the most desirable side should be the side pointing toward the spray lines). As an example, if the can or card is off the right wing, the outward normal should be (0,-1,0); if the receptor is off the left wing, the outward normal is (0,1,0) -- the normals "point" toward the aircraft. Because cans may spin around in the presence of vortices, predicted deposition from the front half of a can should probably be averaged with predicted deposition from the back half of a can.

Dispersion Contribution: "total non-gaseous" refers to all of the released spray material (some of which may evaporate -- up to its "volatile fraction"; this option will give how much of the entire tank mix is left); "nonvolatile" is the part of the released spray material that will not evaporate; and "active" is the part of the released spray material that contains the active ingredient (the reason the stuff is sprayed in the first place).

Emission Rate: units exist in FSCBG for both fluid ounces or weight ounces, and there may be some confusion here. Typically, if the Flow Rate is given in gal/ac, then fluid ounces (ozf) is the desired output if someone wants the deposition in "ounces".

Ground Deposition pattern from near wake: if the pattern dips much more than it should, there are probably too few drop size categories to represent the mass size distribution accurately. Use Interpolate to increase the number of drop sizes. BUT, if the swath pattern is all that is needed, 16 drop sizes should be sufficient. Furthermore, if the aircraft is particularly close to the ground (like 10 feet or less and especially a helicopter), there may be "spikes" of deposition because of the downwash and specific locations of nozzles and the influence of wing-tip/rotor vortices. More drop sizes may be needed in this case as well.

Information List: an Information List for the "lite" version of the model was discussed and will hopefully be used (it is reproduced at the end of this report).

Isopleths: it might help to relate deposition isopleths to a weather map and barometric pressure, or wind intensity around a tropical storm, or even Highs and Lows. Particulates from smoke stacks are sometimes shown by isopleths of equal lines of concentration.

Layer Average: this meteorological input may be confusing. Selecting either a layer average input or input at one specific height for temperature, relative humidity and/or wind direction produces the SAME average values used by the model. The difference arises in wind speed, where different profiles can result from layer average or specific height input. If a value is specified by someone, chances are it will be estimated (or recorded) at a specific height (say 6 feet, or 10 or 30 feet as with the EMCOT weather station). Layer average takes into account the wind profile all the way to the Mixing Height, and this information just isn't going to be available. Our suggestion is to set meteorological input at 6 feet unless told otherwise.

Mass Size Distribution: comes in either "average" or "upper" (although FSCBG will always convert "upper" to "average" when doing actual computations). Only the drop diameters change; the mass fractions for each category remain the same. With regard to library entries: if deposition under the flight lines is what is requested, the library entries as is are fine; however, if drift is requested, then no mass size category should have more than 0.02 mass fraction in it. Interpolate is the option to create additional drop size categories and correct this problem. If small drops (less than 32 microns) are needed, then Curvefit will have to be used (setting the Minimum Diameter to 10 micrometers and Number of Drop Sizes to between 60 and 100 -- there are 100 drop size categories possible in FSCBG). The guru prefers "average". WARNING: menus exist for both average and upper diameters, but the user cannot move from one to the other with the same drop size distribution. The original library is all in "upper" diameter; if the user does not select "average" in Interpolate or Curvefit, the drop size distribution received from the library will stay "upper"; otherwise, it will become "average".

Net Radiation Index: generally, spraying takes place in the early morning hours, where the Net Radiation Index may be taken as 1.0. Calculate Net Radiation Index will enable FSCBG to calculate Net Radiation for a particular scenario.

Source Geometry: automatic flight line generation is the easy way for a simple spray block area; then editing these lines to accommodate the actual spray area. The Preview Plot is a quick way to see whether the Source Geometry and Receptor Grid input are correct.

Swath Width: used to calculate emission for Emission Rates specified on a per area basis. In Near Wake plot options Swath Width is computed from the problem specified, and is used to set the in-swath deposition pattern (but it does NOT correct or change the Swath Width input -- this substitution must be done by the user).

Wake Model: three options exist in FSCBG. Near Wake (with the Ground handoff option) should be used when the aircraft is close to the ground (less than 100 feet release height) when you want to see the drift; it includes the aircraft vortices, propeller wash and helicopter downwash effects; it should ALWAYS be used regardless of release height if drift is desired. Wake Settling should be used above 100 feet release height and is perhaps a better model for helicopters (because the rotor downwash is modeled as well as with Near Wake) than for fixed-wing aircraft; it should be used as a first-cut at isopleths (because it is so much faster). No Wake should be used for ground sprayers or for very high releases (generally above 300 feet). These suggestions may be summarized as follows:

[illegible]

[illegible] introduce the SAM [illegible] used, where [illegible] is specified by a [illegible] specific [illegible] 6 feet [illegible] 10 [illegible] average takes into account the [illegible]

[illegible] distribution [illegible]

[illegible] library [illegible]

[illegible] Circulation [illegible] Consult [illegible] Circulation Index [illegible] calculate the median [illegible]

[illegible]

[illegible] Circulation lists [illegible]

[illegible]

Release Height	Desired Results	Wake Model to Use	Handoff Option
All Heights	Predict Drift or Single Swath Deposition	Near Wake	Ground
Less than 100 ft	Isopleths	Near Wake	Vortex Decay
100 ft to 300 ft	Isopleths	Wake Settling	N/A
Greater than 300 ft	Isopleths	No Wake	N/A
N/A	Ground Sprayer	No Wake	N/A

Example Calculations

Throughout the training session we examined input scenarios and discussed several "what-if" conditions (clearly we could not cover all the situations that could ever exist). More specifically, a sample case suggested by Jack was investigated (full boom vs three-fourths boom; two release heights; what is the downwind drift; etc.).

A mass size distribution library example was examined, and we also computed the Net Radiation Index for Princeton, NJ.

A "lite" calculation led to Results options, especially Dispersion Contribution. Vertical Flux and Drift Fraction were also examined. There was no near-wake deposition, and that was explained by the Vortex Decay handoff set in "lite"; the Gaussian model found the solution.

A demo "what-if" situation was examined as well.

A "review" session included many questions about model inputs and outputs.

CASPR

A general review of inputs to the aircraft efficiency model, with a specific look at the effect of reversing the Length and Width of a rectangular field, and the effects of different number of turns. The aircraft always flies along the LENGTH of a rectangular field.

DOS Interface with Windows

To transfer plots easily: 1) run FSCBG in a "DOS Box"; 2) bring up the desired plot; 3) press "Alt-PrtSc" which copies the plot on the screen to the Clipboard; 4) press "Alt-Tab" to transfer control to the Program Manager, then hold down "Alt" and press "Tab" repeatedly to get to the desired "page"; 5) start Paintbrush (or another paint program); 6) select "Edit" and then "Paste" and the plot appears; 7) make appropriate changes (text, colors, etc.); 8) print; and 9) return to FSCBG with "Alt-Tab" or by double-clicking the icon at the bottom of the screen.

To print text files: 1) start Notepad or Word or whatever; 2) load in the desired "prt" file written by FSCBG; and 3) print it.

To make an FSCBG Program Manager Icon: 1) in Program Manager open the Program Group in which you will place the icon; 2) select "File" and then "New"; 3) click "Browse" and locate fscbg.exe; 4) enter "FSCBG" in the description; 5) enter the fscbg directory (how to get to fscbg.exe) in the Working Directory; 6) click "Change Icon"; then 7) click on "Browse" and locate fscbg.ico.

Spread Factor Data Base

Data base modifications and routine maintenance within Paradox are desired, but, to make changes, a copy of the data base must permit "full" access (we send out only "read-only" copies so that no one can make inadvertent changes to data base inputs). The unprotected database file is called "patsp" and can be accessed as a Table, exactly as the old, protected version was accessed.

To edit the unprotected database: 1) enter the Table as before and press function key F9; this turns on the editor (at any time during editing, pressing F9 will toggle the editor switch); 2) when the cursor is in the field to edit, using the "backspace" key erases characters in the field; 3) all Windows editing commands work (i. e., portions of the field can be marked by dragging with the mouse, and then cut, copied and pasted with keystrokes or from the menu bar). The Paradox for Windows manual gives a detailed description of all the editing functions. Two Guthion entries were changed for practice.

To add password protection and auxiliary protection (read-only access) to an unprotected database: All such changes to a Table are considered structural changes and are defined under the "Restructure" menu of the "Table" option in the main menu bar. "Restructure" opens a window allowing the user to define Table properties, one of which is "Password Security". This option allows the user to establish a password for initial table access. Under the "Auxiliary Password" option of "Table Properties", the user can set FIELD RIGHTS such as read-only restrictions. It's easy to add protection to a file, but somewhat harder to remove protection. Only the person who created the file can remove protection; and protection carries over whenever the file is copied. Thus, protection on the original "spf" file cannot be removed.

Expectations

Before the training began, several critical topic areas were identified as requiring attention. They are:

1. Stability. Presently, stability is entered (for near field and far field) with the net radiation index. We have tied this variable to time of day (in the training sessions) as a convenient way of indicating the level of possible atmospheric stability present. A value of 1.0 for Net Radiation Index is good for early morning spray releases. Rule-of-thumb (as found in the FSCBG training materials) would suggest values of 2.0 for 8 am to 10 am; 3.0 for 10 am to noon; 4.0 for noon to 2 pm; 3.0 for 2 pm to 4 pm; 2.0 for 4 pm to 6 pm; and 1.0 for 6 pm to nightfall.

2. Review FSCBG capability. Done.

[illegible]

[illegible] in Program [illegible] when [illegible] "Window" and [illegible] in the Master Directory [illegible] "Change Icon" [illegible]

[illegible] items [illegible] designed [illegible] have [illegible] it is called "pure" [illegible] can be used [illegible] a table [illegible]

Multiple [illegible] the table [illegible] and [illegible] for Windows manual gives [illegible] entered [illegible] practice

[illegible] of the [illegible] in the [illegible] or [illegible] for [illegible] Only the [illegible] and the [illegible] This [illegible]

3. Information and more questions. This is probably the toughest question to deal with, because the "what-ifs" generally arise under pressure conditions where answers are needed rapidly (setting up inputs to FSCBG and running the model takes time that must be factored in when requesting work). Tried "what-ifs" throughout the training.

4. Type of questions. The new Information List should be a good start here.

5. Short version. FSCBG "lite" discussed.

6. Droplet spectrum. FSCBG predicts the drop spectrum but the program must be modified (in a later version) to extract additional desired information.

7. Vertical receptors. Explained.

8. Units. Reviewed.

9. FSCBG Demo. Tutorial conducted.

10. Buffer Zone. Explained.

11. Other topics discussed included: 1) the number of drop size categories needed for accurate predictions (16 in-swath; 60 or more for off-target drift); 2) the number of nozzles needed for good results (20 minimum -- but first use Wake Settling to generate a fast isopleth plot); 3) how to maintain smooth deposition profiles downwind (enough drop size categories as mentioned above); 4) deposition in drops and mass both discussed; 5) a reasonable limit on the number of flight lines (fewer than 20 or use COMBINE, or wait for an improvement in the model); and 6) receptor locations in-swath and downwind discussed.

FSCBG INFORMATION LIST
July 1995

Requester Name ______________________________
Address ______________________________
____
Telephone Number ____________________
Fax Number ____________________
Purpose of Runs ______________________________
____

FSCBG requires the following data entries. Please specify them and their units:

Aircraft Type ____________________
Release Height ____________________
Canopy Height (Ground = 0.0) ____________________
Nozzle Type ____________________
Number of Nozzles ____________________
Spray Material ____________________
Nonvolatile Fraction of Spray Material ____________________
Active Fraction of Spray Material ____________________
Aircraft Spraying Speed ____________________
Emission Rate ____________________
Swath Width ____________________
Number of Flight Lines ____________________
Temperature ____________________
Relative Humidity ____________________
Wind Speed (at a height of __________ feet) ____________________
Wind Direction Relative to Flight Lines ____________________

Output Variables:

___ Dosage Specify units: ____________________
___ Concentration Specify units: ____________________
___ Deposition Specify units: ____________________
Special plots, answers, needs (please specify): ____________________
____
____